

Consequences Of Tractor Accidents In The Agriculture In Republic Of Macedonia

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ABSTRACT

In this paper are the results from the research of the consequences of tractor accidents in the agriculture in Republic of Macedonia. During the research from 1999 till 2003, 610 people have been injured in Republic of Macedonia in agricultural production, and the tractors have been the main reason. 544 people have been injured in tractor traffic accidents and 66 have been injured during tractor operating in agricultural condition. From the total number, 101 people have died during this period of time. 57 people have died in tractor traffic accidents and the rest of 44 people during tractor operating in agricultural condition. During the research, 172 people have been registered with hard injuries. 151 people have been injured in tractor traffic accidents and 21 during tractor operating in agricultural condition. Light injuries are also part of injuries that happen during tractor operating. During this research another 337 people have been registered with light injuries. The main causes of tractor accidents in the agriculture in Republic of Macedonia are: inattention of the tractor operator, improper speed according to the signs and road conditions, alcohol and malfunctions of the vehicle.

Key words: agriculture, tractor, accidents, causes of accidents, consequences of accidents, fatal injuries

INTRODUCTION

Today the agriculture is considered as a relatively dangerous branch of the economy and it is ranged as the second just beside the construction in accordance to the number of accidents. Huge number of different machines and equipment which are used in agriculture on the field are very often the main reasons for injuring poorly trained farmers.

Today the agricultural production cannot be imagined without using agricultural machines, and the basic machine that is number one in agriculture is the tractor. In many circumstances in accordance to the literature *American Society of Agricultural Engineers (1992b, 1992c)* the tractors are potentially very dangerous power machines especially in case if they are not used by certain rules of safety (*Oljača V. M. et al., 2001.*), prevention and protection, and law regulations.

In accordance to the literature *Dawna and Johnson (Bulletin#2323)*, and *American Society of Agricultural Engineers (1992b)*, it is also known that the tractor is shown as the first and the most important cause of accidents on the farms in agriculture, forestry or construction or in public traffic where the reasons for accidents were mostly: *inappropriate operating* (driving tractor with improper speed on the roads, slopes or side hills with possible rollover) or *inappropriate maintaining* (using not-

original spare parts, changing pneumatics, refueling etc.)

In America the tractor is still remaining number one cause of tragic accidents and consequences in agriculture with 21 tragic cases to 100.000 workers. During agricultural production tractors are related to more than 50% of accidents which are happening on the farms and many injuries are categorized from hard injuries to injuries with tragic consequences, New Y.C. for Agricultural Medicine and Health (1998).

According to the literature in agriculture production in the past 10 years have died 800 people in USA, Finland 14, Ireland 31, and Slovenia 35 and in Serbia 75 farmers and tractor owners, average per year.

Injuries and accidents with tragic consequences with participation of man and tractor are critical point of agricultural production in Republic of Macedonia too. In accordance to data taken from the State statistic institute, Medical jurisprudence, Clinical centre and Ministry of internal affairs of Republic of Macedonia during the period of 1993 till 2003, in average per year 14 people have died in tractor traffic accidents. Also in accidents during tractor operating on the field 9 people have died in average in this period, and five of them were tractor drivers and the other four were passengers on the tractor or in the trailer.

MATERIALS AND METHODS

Consequences of tractor accidents in the agriculture in Republic of Macedonia have been analyzed in these fields:

- Transport operations in public traffic on the roads in Macedonia with participation of tractors with or without trailers;
- Accidents during tractor operating in agricultural conditions (country roads, fields etc.);

The data of injured people in agricultural production are taken from the Ministry of internal affairs, State Statistic institute, Clinical Centre, and

Health institutions during the period from 1999 till 2003.

The archives of these institutions were used for collecting data in accordance to the history of disease from the day when the people were received into hospitals, the way how they have been injured, place of accidents, age and etc. The data of research are shown in tables by age, causes and consequences of accidents.

RESEARCH RESULTS

During the research period from 1999 till 2003 in agricultural regions in Republic of Macedonia, 398 accidents have happened with tractors (Tab.1).

Most of total accidents 178 (44,72%) have happened in the Mediterranean region in the cities: Strumica, Kocani, Kavadarci, Radovis, Veles, Valandovo, Stip, Negotino, Sv. Nikole, Gevgelia, Bogdanci, Demir Kapija and in the villages near this cities.

According to the number of tractor accidents it shows that the accidents are dominated in the biggest and well developed agricultural regions, in Republic of Macedonia and statistically the agricultural regions have big influence on the number of accidents.

Detailed analyses of consequences from tractor accidents has shown that in the research period in tractor traffic accidents and accidents with tractors in agricultural conditions on the field 610 people have been injured in total (Tab.2).

This is the total number of injured people who have been on the tractor or trailer in the moment

when the accident has happened. In this number of injured people are also included injured pedestrians or other people who were helping or have been near by the tractor in the moment of accidents.

In this period of the research in accidents with tractors 101 people have died (16,56%), 172 people (28,20%) have had hard injuries with possible disabilities and 337 (55,25%) people have light injuries.

In accordance to the results in the table 2, it can be concluded that from the total number of injured people in accidents with a tractor, more people have been injured 544 or 89,18% in accidents on public roads.

In tractor traffic accidents as a result of driver's mistake or tractor operator's i.e. disrespect of traffic signs and regulations 347 people have been injured or in percentage 56,89%, and because of the bad psycho-physical condition of the drivers and tractor drivers' 133 (21,80%) have been injured.

Table 1. Tractor accidents in agricultural regions in Republic of Macedonia from 1999-2003

Agricultural regions	Year					Total	Average	%
	1999	2000	2001	2002	2003			
Skopje-Kumanvo region	30	16	12	15	12	85	17,0	21,36
Mediterranean region	49	40	25	40	24	178	35,6	44,72
East region	3	8	5	3	1	20	4,0	5,03
West region	12	6	6	9	4	37	7,4	9,30
Big-lakes region	0	4	5	7	2	18	3,6	4,52
Pelagonia region	19	14	10	8	9	60	12,0	15,08
Total	113	88	63	82	52	398	79,6	100
Average	18,83	14,67	10,50	13,67	8,67	66,33		
%	28,39	22,11	15,83	20,60	13,07	100		

$F_{row} = 29,35$

$F_{col.} = 3,74$

$F_{crit,0,05} = 2,71$

$F_{crit,0,05} = 2,87$

$F_{crit,0,01} = 4,10$

$F_{crit,0,01} = 4,43$

Table 2. Consequences of tractor accidents in agriculture in Republic of Macedonia from 1999 to 2003

Consequences	Causes for tractor traffic accidents			Tractor accidents on the field	Total	%
	Disrespect of traffic signs and regulations	Psycho-physical condition	Mistakes of riders, pedestrians and malfunction of vehicle			
Dead	30	20	7	44	101	16,56
Hard injuries	90	37	24	21	172	28,20
Light injuries	227	76	33	1	337	55,25
Total	347	133	64	66	610	100
%	56,89	21,80	10,49	10,82	100	
Total	544 (89,18)			66 (10,82)	610	

During this period of research in tractor accidents in agricultural condition on the field 66 (10,82%) people were injured as a result of a different cause of accidents.

In Table 3 are shown the results which are related to the tractor traffic accidents i.e. accidents because of drivers' mistake or tractor drivers' and it can be concluded that the most of the people 158 or 42,25% have been injured as a result of driving with improper speed i.e. disrespect of traffic signs and road conditions.

Except speed, non-admission of right of way has resulted with 77 (20,59%) injured, and irregular passing with 50 (13,37%) injured people. Disrespect to these traffic regulations has increased the number of injured people in tractor traffic accidents.

In tractor traffic accidents which are a result of bad psycho-physical condition of the tractor drivers and the drivers of other vehicles 133 people (died, hard or light injured) have been injured in total (Table 4).

Table 3. Injured people in tractor traffic accidents in Republic of Macedonia from 1999 to 2003

Year	Causes of traffic accidents						Total
	Improper speed	Irregular passing	Improper bypass	Irregular move	Non-admission of right of way	Stopping and parking	
1999	51	12	1	8	14	3	89
2000	26	18	2	5	23	4	78
2001	23	6	2	11	11	7	60
2002	42	4	0	12	19	5	82
2003	16	10	0	1	10	1	38
Total	158	50	5	37	77	20	347
Average	31,60	10,00	1,00	7,40	15,40	4,00	69,40
%	42.25	13.37	1.34	9.89	20.59	5.35	100

$F_{row} = 1,57$

$F_{col.} = 13,47$

$F_{crit_{0,05}} = 2,86$

$F_{crit_{0,05}} = 2,71$

$F_{crit_{0,01}} = 4,43$

$F_{crit_{0,01}} = 4,10$

Table 4. Injured people in tractor traffic accidents in agriculture in Republic of Macedonia from 1999 to 2003

Year	Causes of tractor traffic accidents					Total
	Psycho-physical condition		Experience		Other mistakes	
	Alcohol	Other	Poorly experience	Disrespect of regulations		
1999	25	4	4	1	5	39
2000	14	2	3	4	5	28
2001	14	0	2	1	2	19
2002	14	3	1	1	9	28
2003	10	3	2	0	4	19
Total	77	12	12	7	25	133
Average	15,40	2,40	2,40	1,40	5,00	26,60
%	57.89	9.02	9.02	5.26	18.80	100

$F_{row} = 1,79$

$F_{col.} = 21,96$

$F_{crit_{0,05}} = 3,01$

$F_{crit_{0,05}} = 3,01$

$F_{crit_{0,01}} = 4,77$

$F_{crit_{0,01}} = 4,77$

Most of the people 77 or 57,89% have been injured in tractor traffic accidents. The cause for these accidents is alcohol consuming by the drivers. Except the alcohol as a cause of accidents another 12 people have been injured because of some other factors which lead to bad psycho-physical condition (disease, tiredness, using pills and narcotic drugs) of the tractor drivers and the other participants.

Inexperience of tractor operators and other drivers which are leading to disrespect of traffic signs and regulations has caused bigger number of injured people. In this period 19 people or 14,28% have been injured from the total number of injured as a result to the above mentioned factors.

In tractor traffic accidents another 64 people have been injured as a result to the pedestrians' mistake, passengers or technical malfunction of the vehicles

(Table 5). In the period of research from 1999 till 2003 most of the people 44 or 68.75% have been injured because of technical malfunction of the vehicles.

Having in concern that in Macedonia of about 50.000 tractors only 5,77% are registered, the responsibility of the agricultural equipment i.e. tractors is further bigger for injuries to these people (Record Ministry of internal affairs, 2003). So, it is not enough to do the technical checking only when the tractor changes the owner (even in most of the cases this part of law regulation is avoided) but it is necessary to respect the law regulation completely where it is conducted regular checking of the technical function of the tractor when they are used on public roads at least once in a year.

Table 5. Injured people in tractor traffic accidents in Republic of Macedonia from 1999 to 2003

Year	Causes of tractor traffic accidents					Total
	Mistakes			Condition of road	Other factors	
	Pedestrians	Passengers	Malfunction of vehicle			
1999	3	4	19	0	0	26
2000	1	0	21	1	1	24
2001	1	0	2	1	1	5
2002	0	2	0	0	0	2
2003	1	1	2	0	3	7
Total	6	7	44	2	5	64
Average	1,20	1,40	8,80	0,40	1,00	12,80
%	9.38	10.94	68.75	3.13	7.81	100

$F_{row} = 1,89$

$F_{col.} = 2,86$

$F_{crit_{0,05}} = 3,01$

$F_{crit_{0,05}} = 3,01$

$F_{crit_{0,01}} = 4,77$

$F_{crit_{0,01}} = 4,77$

Table 6. Injured farmers in tractor accidents on the field from 1999 to 2003 in Republic of Macedonia

Year	Causes of accidents						Total
	Inattention	Malfunction of tractor	Slip terrain	Lose of control	Slope terrain	Unknown	
1999	10	0	0	0	0	5	15
2000	7	0	0	1	0	8	16
2001	4	0	0	0	1	6	11
2002	9	1	0	2	0	3	15
2003	2	0	0	2	2	3	9
Total	32	1	0	5	3	25	66
Average	6,40	0,20	0,00	1,00	0,60	5,00	13,20
%	48,48	1,52	0	7,58	4,55	37,88	100

$F_{row} = 0,47$

$F_{col.} = 11,78$

$F_{crit_{0,05}} = 2,87$

$F_{crit_{0,05}} = 2,71$

$F_{crit_{0,01}} = 4,43$

$F_{crit_{0,01}} = 4,10$

Except people who have been injured in tractor traffic accidents in this period another 66 people have been registered who have been injured during exploitations of tractors in agricultural condition on the field. The number of injured in accordance to the causes of the accidents during tractor operating in agricultural condition are presented in Table 6.

In accordance to the Table 6, during tractor exploitation in the field, or transport operations on rural roads, most of the farmers 32 (48,48%) have been injured (died, hard or light injured) as a result of inattention of tractor operator.

Tractor accidents on the field when rollover has happened often ended with hard injuries and fatal consequences to the tractor operator or to the people who are on the tractor or near by. In such circumstances it is difficult to find out what was the cause of the accident especially if the tractor operator was alone on the tractor. So in the Table there are 25 (37,88%) registered cases in which there is not clear evidence about cause of the accident.

It is necessary to mention that the average oldness of tractors in Republic of Macedonia is more than 26 years, according to the State Statistical Institute. In this condition most of the tractors are dangerous and unsafe for exploitations, because they are not equipped with cabins or rollover frame, and usually have technical problems (steering system, brakes, lights, etc)

During the research period with analyzing data, the number of injured people (farmers) is exactly

confirmed, who were on the tractor, in the trailer or they were near by helping and doing agricultural work at the moment of the accident. That means that from the total number of injured people (610), in accidents with a tractor 284 farmers in total were injured (Table 7).

According to the results of the Table7, it can be concluded that the most of farmers 218 (76,76%) are injured in tractor traffic accidents. From those 218 injured farmers in traffic accidents 116 or 40,85% were tractor operators and 102 or 35,92% were passengers on the tractor. In tractor accidents in agricultural conditions on the field, 53 injured farmers were tractor operators, 5 were passengers and 8 farmers were injured because they were near by the tractor in the moment of accidents.

Most of the farmers 67 (23,59%) who have been injured were on age from 35 to 45 years and 54 (19,01%) farmers in a group from 45 to 55 years of age. In accordance to the age structure of the participants in tractor traffic accidents, most farmers 35 are tractor operators, and they are on age from 35 to 45 years. In the other group from 45 to 55 years of age, 24 tractor operators have been injured. This table shows up also that in tractor traffic accidents 7 tractor operators have been injured who were over 65 years old and another 4 tractor operators who are in a group from 7 to 14 years old, or more precisely 1 tractor operator with hard injuries had only 11 years and the other 3 had light injuries.

Table 7. Injured farmers in tractor accidents in agriculture from 1999 to 2003 in Republic of Macedonia

Year	Tractor traffic accidents		Tractor accidents on the field			Total	%
	Tractor operators	Passengers	Tractor operators	Passengers	People injured near by the tractor		
< 7	0	6	0	1	3	10	3,52
7 - 14	4	10	0	1	1	16	5,63
14 - 18	3	11	2	1	0	17	5,99
18 - 25	8	12	3	1	1	25	8,80
25 - 35	18	9	4	1	0	32	11,27
35 - 45	35	18	14	0	0	67	23,59
45 - 55	24	16	12	0	2	54	19,01
55 - 65	17	9	7	0	1	34	11,97
> 65	7	11	11	0	0	29	10,21
Total	116	102	53	5	8	284	
Total	218 (76,76%)		66(23,24%)			284	
%	40,85	35,92	18,66	1,76	2,82	100	

Most of injured tractor operators in accidents with tractors on the field (14) are in the group from 35 to 45 years of age, and just a little bit less 12 tractor operators are in a group from 45 to 55. In the group from 14 to 18 years, 2 tractor operators have been injured. One of them have had hard injuries with fatal consequences and he was only 14 years old.

Analyses on the age structure of the injured passengers in tractor traffic accidents, shows that the most of the injured passengers on the tractor 18 are in the group from 35 to 45 years. It should be mentioned that as riders 6 farmers' children have been injured and they had less than 7 years. 3 of them have died and the other 3 were with light injuries. 11 injured passengers have been 65 years old and 3 of them died, 4 have had hard injuries and 3 were with light injuries.

In tractor accidents on the field as passengers 5 people have been injured. One of them was a child and the other 3 younger people up to 18 years old, members of the farmer's family.

The number of injured passengers on the tractor confirms the tractor producer's warning and law regulations that the use of tractors is not for passengers transport and the approach on the tractor for other people is allowed only when there is an additional seat on it but only if it is built up in by the producer.

During the research period another 8 people have been registered (3 children under 7 years old and 1 of 14 years) who have been injured in accident because at that moment they were near by the tractor.

CONCLUSION

In accordance to the analyses of consequences of tractor accidents in agriculture in Republic of Macedonia the following can be concluded:

1. From 1999 till 2003 398 tractor accidents have happened and 610 people have been injured in total. From them 544 (89,18%) have been injured in tractor

traffic accidents and 66 (10,82%) in tractor accidents in agricultural condition on the field.

2. From the total number of injured people 101(16,56%) people have died, 172 (28,20%) have had hard injuries and 337 (55,25%) have had light injuries.

3. Most people in tractor traffic accidents have been injured as a result of:

- improper speed of tractors and other vehicles on public roads in accordance to the traffic signs and road conditions
- consuming alcohol
- technical malfunction of the vehicle

4. Most people injured during tractor operating in agricultural condition on the field have been injured because of tractor operator's inattention.

5. From the total number of injured people in tractor traffic accidents or in accidents in agricultural conditions 284 are farmers. From them:

- 218 (76,76%) in traffic accidents, 116 tractor operators and 102 passengers
- 66 (23,24%) in accidents on the fields, 53 tractor operators, 5 passengers and 8 people who were near by the tractor when the accident happened.

6. Most of the farmers injured in tractor accidents are in the age group from 35 to 45 years.

7. Except older farmers in accidents children are included too. During the research period 10 children under 7 years of age have been injured, 16 children from 7 to 14 years and 17 young people from 14 to 18 years.

8. In accordance to the number of injured farmers in tractor traffic accidents and accidents in agricultural conditions the necessity of organizing training for tractor operators is unavoidable. In this training they should be educated about tractor safety rules during exploitations, more control to the technical conditions of the tractors, and more control to the drivers and tractor operators by the traffic police especially in the bigger agricultural regions in Republic of Macedonia.

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